



SEQUENCE LISTING

<110> RIEPING, Mechthild
THIERBACH, Georg

<120> Process for the fermentative preparation of L-amino acids using strains of the Enterobacteriaceae family.

<130> 218162US0X

<140> 10/076,416

<141> 2002-02-19

<150> DE 10112107.5

<151> 2001-03-14

<150> US 09/987541

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a7

<150> US 60/283612

<151> 2000-04-16

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<170> PatentIn version 3.1

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| Met | Lys | Gln | Thr | Val | Ala | Ala | Tyr | Ile | Ala | Lys | Thr | Leu | Glu | Ser | Ala | |
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| | | | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|
| ggg | gtg | aaa | cgc | atc | tgg | gga | gtc | aca | ggc | gac | tct | ctg | aac | ggg | ctt | 96 |
| Gly | Val | Lys | Arg | Ile | Trp | Gly | Val | Thr | Gly | Asp | Ser | Leu | Asn | Gly | Leu | |
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| agt | gac | agt | ctt | aat | cgc | atg | ggc | acc | atc | gag | tgg | atg | tcc | acc | cgc | 144 |
| Ser | Asp | Ser | Leu | Asn | Arg | Met | Gly | Thr | Ile | Glu | Trp | Met | Ser | Thr | Arg | |
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| | | | | | | | | | | | | | | | | |
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| cac | gaa | gaa | gtg | gcg | gcc | ttt | gcc | gct | ggc | gct | gaa | gca | caa | ctt | agc | 192 |
| His | Glu | Glu | Val | Ala | Ala | Phe | Ala | Ala | Gly | Ala | Glu | Ala | Gln | Leu | Ser | |
| | 50 | | | | | 55 | | | | | 60 | | | | | |

| | | | | | | | | | | | | | | | | |
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| gga | gaa | ctg | gcg | gtc | tgc | gcc | gga | tcg | tgc | ggc | ccc | ggc | aac | ctg | cac | 240 |
| Gly | Glu | Leu | Ala | Val | Cys | Ala | Gly | Ser | Cys | Gly | Pro | Gly | Asn | Leu | His | |
| 65 | | | | | 70 | | | | | 75 | | | | | 80 | |

| | | | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| tta | atc | aac | ggc | ctg | ttc | gat | tgc | cac | cgc | aat | cac | gtt | ccg | gta | ctg | 288 |
| Leu | Ile | Asn | Gly | Leu | Phe | Asp | Cys | His | Arg | Asn | His | Val | Pro | Val | Leu | |
| | | | 85 | | | | | 90 | | | | | | 95 | | |

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| gcg | att | gcc | gct | cat | att | ccc | tcc | agc | gaa | att | ggc | agc | ggc | tat | ttc | 336 |
| Ala | Ile | Ala | Ala | His | Ile | Pro | Ser | Ser | Glu | Ile | Gly | Ser | Gly | Tyr | Phe | |
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| cag | gaa | acc | cac | cca | caa | gag | cta | ttc | cgc | gaa | tgt | agt | cac | tat | tgc | 384 |
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|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| Gln | Glu | Thr | His | Pro | Gln | Glu | Leu | Phe | Arg | Glu | Cys | Ser | His | Tyr | Cys | |
| | | 115 | | | | | 120 | | | | | 125 | | | | |
| gag | ctg | gtt | tcc | agc | ccg | gag | cag | atc | cca | caa | gta | ctg | gcg | att | gcc | 432 |
| Glu | Leu | Val | Ser | Ser | Pro | Glu | Gln | Ile | Pro | Gln | Val | Leu | Ala | Ile | Ala | |
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| atg | cgc | aaa | gcg | gtg | ctt | aac | cgt | ggc | gtt | tcg | gtt | gtc | gtg | tta | cca | 480 |
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| 145 | | | | | 150 | | | | | 155 | | | | | 160 | |
| ggc | gac | gtg | gcg | tta | aaa | cct | gcg | cca | gaa | ggg | gca | acc | atg | cac | tgg | 528 |
| Gly | Asp | Val | Ala | Leu | Lys | Pro | Ala | Pro | Glu | Gly | Ala | Thr | Met | His | Trp | |
| | | | | 165 | | | | | 170 | | | | | 175 | | |
| tat | cat | gcg | cca | caa | cca | gtc | gtg | acg | ccg | gaa | gaa | gaa | gag | tta | cgc | 576 |
| Tyr | His | Ala | Pro | Gln | Pro | Val | Val | Thr | Pro | Glu | Glu | Glu | Glu | Leu | Arg | |
| | | | 180 | | | | | 185 | | | | | | 190 | | |
| aaa | ctg | gcg | caa | ctg | ctg | cgt | tat | tcc | agc | aat | atc | gcc | ctg | atg | tgt | 624 |
| Lys | Leu | Ala | Gln | Leu | Leu | Arg | Tyr | Ser | Ser | Asn | Ile | Ala | Leu | Met | Cys | |
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| ggc | agc | ggc | tgc | gcg | ggg | gcg | cat | aaa | gag | tta | gtt | gag | ttt | gcc | ggg | 672 |
| Gly | Ser | Gly | Cys | Ala | Gly | Ala | His | Lys | Glu | Leu | Val | Glu | Phe | Ala | Gly | |
| | 210 | | | | | 215 | | | | | 220 | | | | | |
| aaa | att | aaa | gcg | cct | att | gtt | cat | gcc | ctg | cgc | ggt | aaa | gaa | cat | gtc | 720 |
| Lys | Ile | Lys | Ala | Pro | Ile | Val | His | Ala | Leu | Arg | Gly | Lys | Glu | His | Val | |
| 225 | | | | | 230 | | | | | 235 | | | | | 240 | |
| gaa | tac | gat | aat | ccg | tat | gat | gtt | gga | atg | acc | ggg | tta | atc | ggc | ttc | 768 |
| Glu | Tyr | Asp | Asn | Pro | Tyr | Asp | Val | Gly | Met | Thr | Gly | Leu | Ile | Gly | Phe | |
| a7 | | | | 245 | | | | | 250 | | | | | 255 | | |
| tcg | tca | ggt | ttc | cat | acc | atg | atg | aac | gcc | gac | acg | tta | gtg | cta | ctc | 816 |
| Ser | Ser | Gly | Phe | His | Thr | Met | Met | Asn | Ala | Asp | Thr | Leu | Val | Leu | Leu | |
| | | | 260 | | | | | 265 | | | | | 270 | | | |
| ggc | acg | caa | ttt | ccc | tac | cgc | gcc | ttc | tac | ccg | acc | gat | gcc | aaa | atc | 864 |
| Gly | Thr | Gln | Phe | Pro | Tyr | Arg | Ala | Phe | Tyr | Pro | Thr | Asp | Ala | Lys | Ile | |
| | | 275 | | | | | 280 | | | | | 285 | | | | |
| att | cag | att | gat | atc | aac | cca | gcc | agc | atc | ggc | gct | cac | agc | aag | gtg | 912 |
| Ile | Gln | Ile | Asp | Ile | Asn | Pro | Ala | Ser | Ile | Gly | Ala | His | Ser | Lys | Val | |
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| gat | atg | gca | ctg | gtc | ggc | gat | atc | aag | tcg | act | ctg | cgt | gca | ttg | ctt | 960 |
| Asp | Met | Ala | Leu | Val | Gly | Asp | Ile | Lys | Ser | Thr | Leu | Arg | Ala | Leu | Leu | |
| 305 | | | | | 310 | | | | | 315 | | | | | 320 | |
| cca | ttg | gtg | gaa | gaa | aaa | gcc | gat | cgc | aag | ttt | ctg | gat | aaa | gcg | ctg | 1008 |

| | | | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| Pro | Leu | Val | Glu | Glu | Lys | Ala | Asp | Arg | Lys | Phe | Leu | Asp | Lys | Ala | Leu | |
| | | | | 325 | | | | | 330 | | | | | 335 | | |
| gaa | gat | tac | cgc | gac | gcc | cgc | aaa | ggg | ctg | gac | gat | tta | gct | aaa | ccg | 1056 |
| Glu | Asp | Tyr | Arg | Asp | Ala | Arg | Lys | Gly | Leu | Asp | Asp | Leu | Ala | Lys | Pro | |
| | | | 340 | | | | | 345 | | | | | 350 | | | |
| agc | gag | aaa | gcc | att | cac | ccg | caa | tat | ctg | gcg | cag | caa | att | agt | cat | 1104 |
| Ser | Glu | Lys | Ala | Ile | His | Pro | Gln | Tyr | Leu | Ala | Gln | Gln | Ile | Ser | His | |
| | | 355 | | | | | 360 | | | | | 365 | | | | |
| ttt | gcc | gcc | gat | gac | gct | att | ttc | acc | tgt | gac | gtt | ggg | acg | cca | acg | 1152 |
| Phe | Ala | Ala | Asp | Asp | Ala | Ile | Phe | Thr | Cys | Asp | Val | Gly | Thr | Pro | Thr | |
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| gtg | tgg | gcg | gca | cgt | tat | cta | aaa | atg | aac | ggc | aag | cgt | cgc | ctg | tta | 1200 |
| Val | Trp | Ala | Ala | Arg | Tyr | Leu | Lys | Met | Asn | Gly | Lys | Arg | Arg | Leu | Leu | |
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| ggg | tcg | ttt | aac | cac | ggg | tcg | atg | gct | aac | gcc | atg | ccg | cag | gcg | ctg | 1248 |
| Gly | Ser | Phe | Asn | His | Gly | Ser | Met | Ala | Asn | Ala | Met | Pro | Gln | Ala | Leu | |
| | | | | 405 | | | | | 410 | | | | | 415 | | |
| ggg | gcg | cag | gcg | aca | gag | cca | gaa | cgt | cag | gtg | gtc | gcc | atg | tgc | ggc | 1296 |
| Gly | Ala | Gln | Ala | Thr | Glu | Pro | Glu | Arg | Gln | Val | Val | Ala | Met | Cys | Gly | |
| | | | 420 | | | | | 425 | | | | | 430 | | | |
| gat | ggc | ggg | ttt | agc | atg | ttg | atg | ggc | gat | ttc | ctc | tca | gta | gtg | cag | 1344 |
| Asp | Gly | Gly | Phe | Ser | Met | Leu | Met | Gly | Asp | Phe | Leu | Ser | Val | Val | Gln | |
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| atg | aaa | ctg | cca | gtg | aaa | att | gtc | gtc | ttt | aac | aac | agc | gtg | ctg | ggc | 1392 |
| Met | Lys | Leu | Pro | Val | Lys | Ile | Val | Val | Phe | Asn | Asn | Ser | Val | Leu | Gly | |
| | 450 | | | | | 455 | | | | | 460 | | | | | |
| ttt | gtg | gcg | atg | gag | atg | aaa | gct | ggg | ggc | tat | ttg | act | gac | ggc | acc | 1440 |
| Phe | Val | Ala | Met | Glu | Met | Lys | Ala | Gly | Gly | Tyr | Leu | Thr | Asp | Gly | Thr | |
| 465 | | | | | 470 | | | | | 475 | | | | | 480 | |
| gaa | cta | cac | gac | aca | aac | ttt | gcc | cgc | att | gcc | gaa | gcg | tgc | ggc | att | 1488 |
| Glu | Leu | His | Asp | Thr | Asn | Phe | Ala | Arg | Ile | Ala | Glu | Ala | Cys | Gly | Ile | |
| | | | | 485 | | | | | 490 | | | | | 495 | | |
| acg | ggg | atc | cgt | gta | gaa | aaa | gcg | tct | gaa | gtt | gat | gaa | gcc | ctg | caa | 1536 |
| Thr | Gly | Ile | Arg | Val | Glu | Lys | Ala | Ser | Glu | Val | Asp | Glu | Ala | Leu | Gln | |
| | | | 500 | | | | | 505 | | | | | 510 | | | |
| cgc | gcc | ttc | tcc | atc | gac | ggg | ccg | gtg | ttg | gtg | gat | gtg | gtg | gtc | gcc | 1584 |
| Arg | Ala | Phe | Ser | Ile | Asp | Gly | Pro | Val | Leu | Val | Asp | Val | Val | Val | Ala | |
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| aaa | gaa | gag | tta | gcc | att | cca | ccg | cag | atc | aaa | ctc | gaa | cag | gcc | aaa | 1632 |

| | | | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| Lys | Glu | Glu | Leu | Ala | Ile | Pro | Pro | Gln | Ile | Lys | Leu | Glu | Gln | Ala | Lys | |
| 530 | | | | | | 535 | | | | | 540 | | | | | |
| ggt | ttc | agc | ctg | tat | atg | ctg | cgc | gca | atc | atc | agc | gga | cgc | ggt | gat | 1680 |
| Gly | Phe | Ser | Leu | Tyr | Met | Leu | Arg | Ala | Ile | Ile | Ser | Gly | Arg | Gly | Asp | |
| 545 | | | | | 550 | | | | | 555 | | | | | 560 | |
| gaa | gtg | atc | gaa | ctg | gcg | aaa | aca | aac | tgg | cta | agg | taa | | | | 1719 |
| Glu | Val | Ile | Glu | Leu | Ala | Lys | Thr | Asn | Trp | Leu | Arg | | | | | |
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| Gly | Val | Lys | Arg | Ile | Trp | Gly | Val | Thr | Gly | Asp | Ser | Leu | Asn | Gly | Leu | |
| | | | 20 | | | | | 25 | | | | | 30 | | | |
| Ser | Asp | Ser | Leu | Asn | Arg | Met | Gly | Thr | Ile | Glu | Trp | Met | Ser | Thr | Arg | |
| | | 35 | | | | | 40 | | | | | 45 | | | | |
| His | Glu | Glu | Val | Ala | Ala | Phe | Ala | Ala | Gly | Ala | Glu | Ala | Gln | Leu | Ser | |
| | 50 | | | | | 55 | | | | | 60 | | | | | |
| Gly | Glu | Leu | Ala | Val | Cys | Ala | Gly | Ser | Cys | Gly | Pro | Gly | Asn | Leu | His | |
| 65 | | | | | 70 | | | | | 75 | | | | | 80 | |
| Leu | Ile | Asn | Gly | Leu | Phe | Asp | Cys | His | Arg | Asn | His | Val | Pro | Val | Leu | |
| | | | | 85 | | | | | 90 | | | | | 95 | | |
| Ala | Ile | Ala | Ala | His | Ile | Pro | Ser | Ser | Glu | Ile | Gly | Ser | Gly | Tyr | Phe | |
| | | | 100 | | | | | 105 | | | | | 110 | | | |

Gln Glu Thr His Pro Gln Glu Leu Phe Arg Glu Cys Ser His Tyr Cys
 115 120 125

Glu Leu Val Ser Ser Pro Glu Gln Ile Pro Gln Val Leu Ala Ile Ala
 130 135 140

Met Arg Lys Ala Val Leu Asn Arg Gly Val Ser Val Val Val Leu Pro
 145 150 155 160

Gly Asp Val Ala Leu Lys Pro Ala Pro Glu Gly Ala Thr Met His Trp
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Tyr His Ala Pro Gln Pro Val Val Thr Pro Glu Glu Glu Glu Leu Arg
 180 185 190

Lys Leu Ala Gln Leu Leu Arg Tyr Ser Ser Asn Ile Ala Leu Met Cys
 195 200 205

Gly Ser Gly Cys Ala Gly Ala His Lys Glu Leu Val Glu Phe Ala Gly
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Lys Ile Lys Ala Pro Ile Val His Ala Leu Arg Gly Lys Glu His Val
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Glu Tyr Asp Asn Pro Tyr Asp Val Gly Met Thr Gly Leu Ile Gly Phe
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Ser Ser Gly Phe His Thr Met Met Asn Ala Asp Thr Leu Val Leu Leu
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Gly Thr Gln Phe Pro Tyr Arg Ala Phe Tyr Pro Thr Asp Ala Lys Ile
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Ile Gln Ile Asp Ile Asn Pro Ala Ser Ile Gly Ala His Ser Lys Val
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Asp Met Ala Leu Val Gly Asp Ile Lys Ser Thr Leu Arg Ala Leu Leu
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Pro Leu Val Glu Glu Lys Ala Asp Arg Lys Phe Leu Asp Lys Ala Leu
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Glu Asp Tyr Arg Asp Ala Arg Lys Gly Leu Asp Asp Leu Ala Lys Pro
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Ser Glu Lys Ala Ile His Pro Gln Tyr Leu Ala Gln Gln Ile Ser His
 355 360 365

Phe Ala Ala Asp Asp Ala Ile Phe Thr Cys Asp Val Gly Thr Pro Thr
 370 375 380

Val Trp Ala Ala Arg Tyr Leu Lys Met Asn Gly Lys Arg Arg Leu Leu
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Gly Ser Phe Asn His Gly Ser Met Ala Asn Ala Met Pro Gln Ala Leu
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Gly Ala Gln Ala Thr Glu Pro Glu Arg Gln Val Val Ala Met Cys Gly
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Asp Gly Gly Phe Ser Met Leu Met Gly Asp Phe Leu Ser Val Val Gln
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Met Lys Leu Pro Val Lys Ile Val Val Phe Asn Asn Ser Val Leu Gly
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Phe Val Ala Met Glu Met Lys Ala Gly Gly Tyr Leu Thr Asp Gly Thr
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Glu Leu His Asp Thr Asn Phe Ala Arg Ile Ala Glu Ala Cys Gly Ile
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Thr Gly Ile Arg Val Glu Lys Ala Ser Glu Val Asp Glu Ala Leu Gln
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Arg Ala Phe Ser Ile Asp Gly Pro Val Leu Val Asp Val Val Val Ala
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Lys Glu Glu Leu Ala Ile Pro Pro Gln Ile Lys Leu Glu Gln Ala Lys
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| aagaagtggc ggcctttgcc gctggcgctg aagcacaact tagcggagaa ctggcggtct | 180 |
| gcgccggatc gtgcggcccc ggcaacctgc acttaatcaa cggcctgttc gattgccacc | 240 |
| gcaatcacgt tccggtactg gcgattgccg ctcatattcc ctccagcgaa attggcagcg | 300 |
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| tggtttccag cccggagcag atcccacaag tactggcgat tgccatgcgc aaagcgggtgc | 420 |
| ttaaccgtgg cgtttcgggtt gtcgtgttac caggcgacgt ggcgttaaaa cctgcgccag | 480 |
| aaggggcaac catgcactgg tatcatgcgc cacaaccagt cgtgacgccg gaagaagaag | 540 |
| agttacgcaa actggcgcaa ctgctgcgtt attccaggcc taagggcgaa ttccagcaca | 600 |
| ctggcgggccg ttactagtgg atccgagatc tgcagaattc gcccttctgc gtgcattgct | 660 |

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a7
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at
CMT

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| atctggggag | tcacaggcga | ctctctgaac | ggtcttagtg | acagtcttaa | tcgcatgggc | 120 |
| accatcgagt | ggatgtccac | ccgccacgaa | gaagtggcgg | cctttgccgc | tggcgctgaa | 180 |
| gcacaactta | gcggagaact | ggcgggtctgc | gcgggatcgt | gcggccccgg | caacctgcac | 240 |
| ttaatcaacg | gcctgttcga | ttgccaccgc | aatcacgttc | cggtactggc | gattgccgct | 300 |
| catattccct | ccagcgaaat | tggcagcggc | tattttccagg | aaaccacccc | acaagagcta | 360 |
| ttccgcgaat | gtagtcacta | ttgcgagctg | gtttccagcc | cggagcagat | cccacaagta | 420 |
| ctggcgattg | ccatgcgcaa | agcggtgctt | aaccgtggcg | tttcggttgt | cgtgttacca | 480 |

ggcgacgtgg cgttaaaacc tgcgccagaa ggggcaacca tgcactggta tcatgcgcca 540
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